

*2011 Government/Industry Meetings
January 27, Washington DC*



Alliance **OF AUTOMOBILE**[®]
MANUFACTURERS

Pedestrian Protection Large Truck/SUV Challenges

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Alliance of Automobile Manufacturers**

2011 Government/Industry Meetings

January 27, Washington DC

Alliance Member Companies

BMW Group

 **General Motors**



TOYOTA



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Mercedes-Benz



SAE International

Presentation Outline

Discussion Items:

- **2008 Traffic Safety Facts: Pedestrians**
- **US Market Trucks/SUVs Data**
- **Large Trucks/SUVs Customer Usage Requirements**
- **Unique Trucks/SUVs Pedestrian Head Challenges**
- **Trucks/SUVs Leg Test Procedure Complexity**
- **Unique Trucks/SUVs Pedestrian Leg Challenges**
- **Alliance FlexGTR Recommendation**
- **Summary**

2008 Traffic Safety Facts: Pedestrians

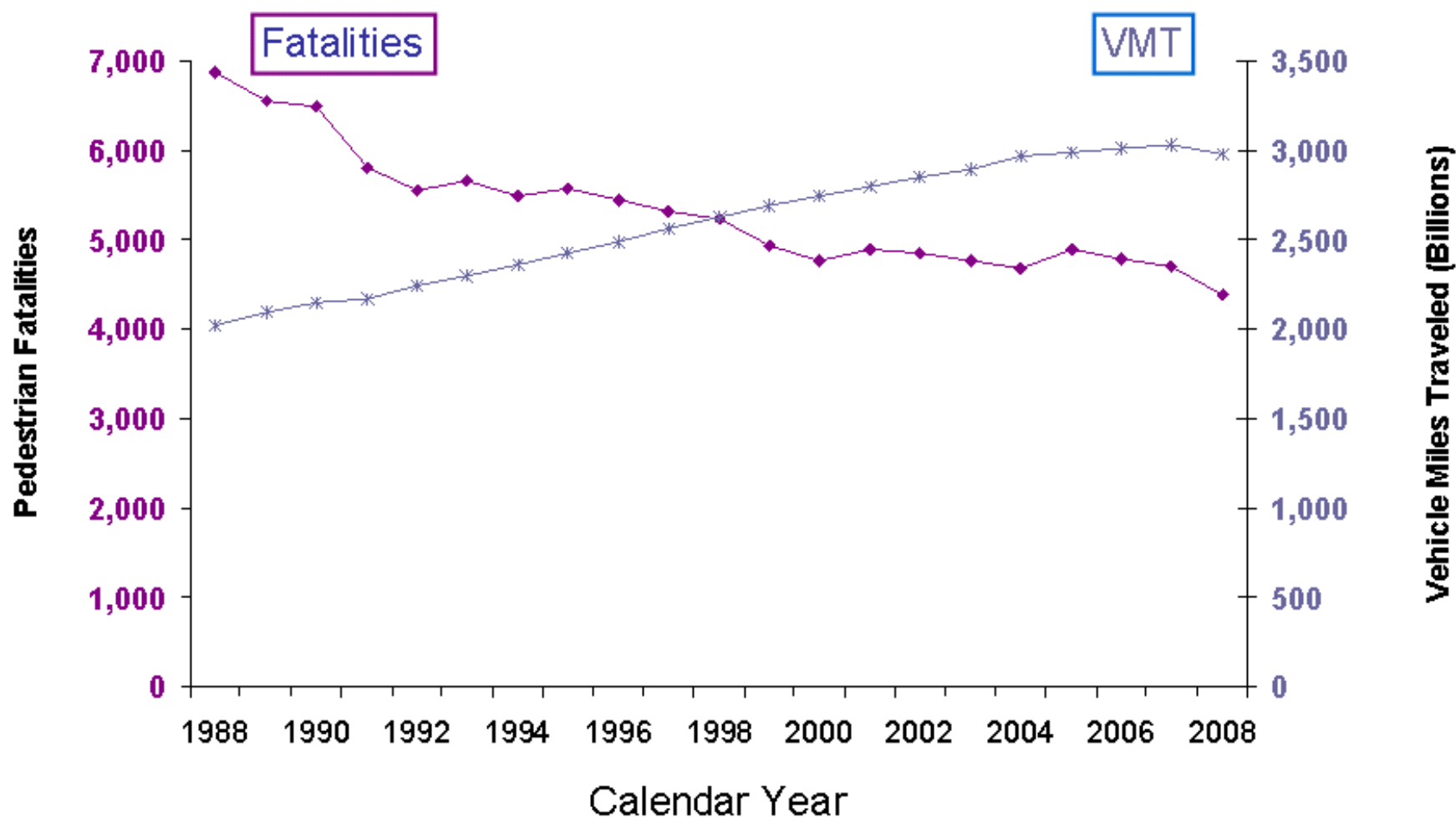
Total U.S. Pedestrian* fatalities in 2008 were 16 percent lower than in 1998.

- Pedestrians account for 83% of non occupant fatalities;
 - 14% of non occupant fatalities were pedal cyclists, and
 - 3% were other (skateboard riders, roller skaters, etc).
- Pedestrian fatalities environmental conditions:
 - 72% in urban areas,
 - 76% at non-intersection locations,
 - 89% in normal weather conditions, and
 - 70% at night.
- 18% of pedestrian fatalities were age 65 and older.
- 7% of pedestrian fatalities were age 15 and younger.

Source: NHTSA DOT HS 811 163 Traffic Safety Facts, "Pedestrians" (2008) – latest available

4 From DOT HS 81 163, "A pedestrian is defined as any person not in or upon a motor vehicle or other vehicle."

Pedestrian Fatalities and Vehicle Miles Traveled



2008 Traffic Safety Facts: Pedestrians

Alcohol involvement was reported for 48% of pedestrian fatality crashes

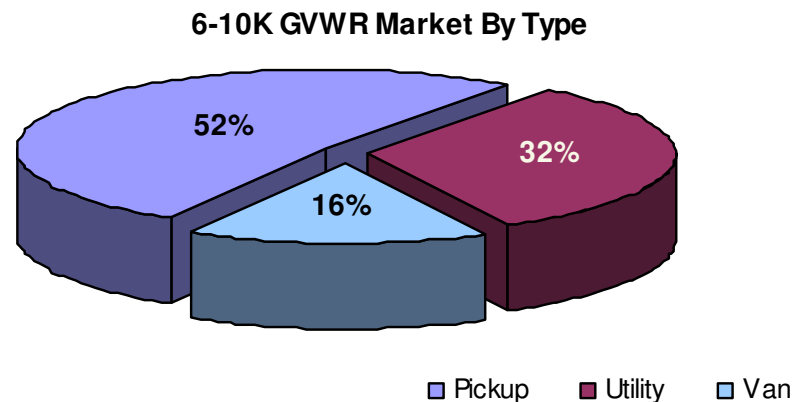
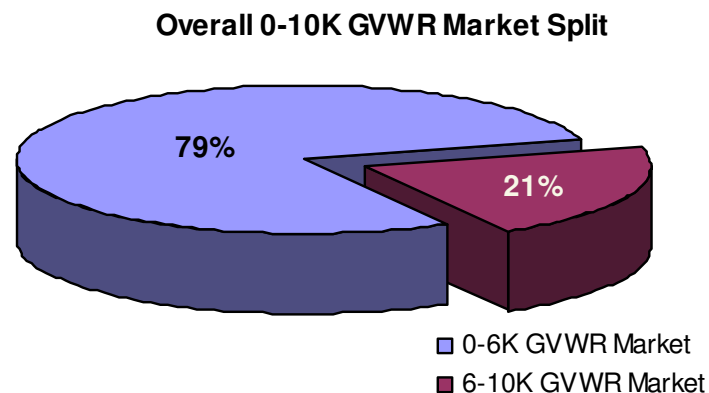
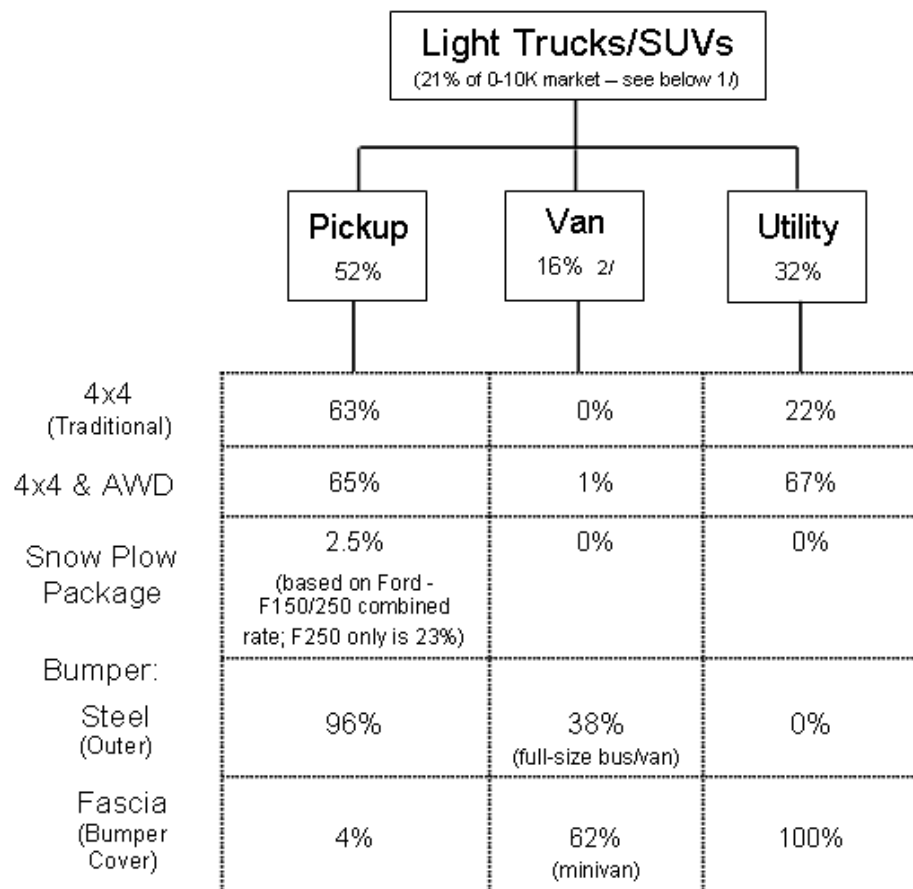
- 36% of fatal pedestrians had a blood alcohol concentration (BAC) of .08 grams per deciliter (g/dL) or higher.
- 13% of drivers in fatal pedestrian crashes had a BAC ≥ 0.08 g/dL
- Only half (52%) fatal pedestrian crashes had both pedestrian and driver with BAC = 0
- 43% of fatal pedestrian crashes had either pedestrian or driver with BAC ≥ 0.08 g/dL.
 - 6% of fatal pedestrian crashes had both pedestrian and driver with BAC ≥ 0.08 g/dL

		Driver Alcohol Involvement (BAC)			Total
		None	.01-.07	$\geq .08$	
Pedestrian Alcohol Involvement (BAC)	None	52%	2%	6%	60%
	.01-.07	3%	0%	1%	4%
	$\geq .08$	28%	2%	6%	36%
Total		82%	4%	13%	100%

Source: NHTSA DOT HS 811 163 Traffic Safety Facts, "Pedestrians" (2008) – latest available

US Light Truck/SUV Market

21% of Total US New Market Registrations

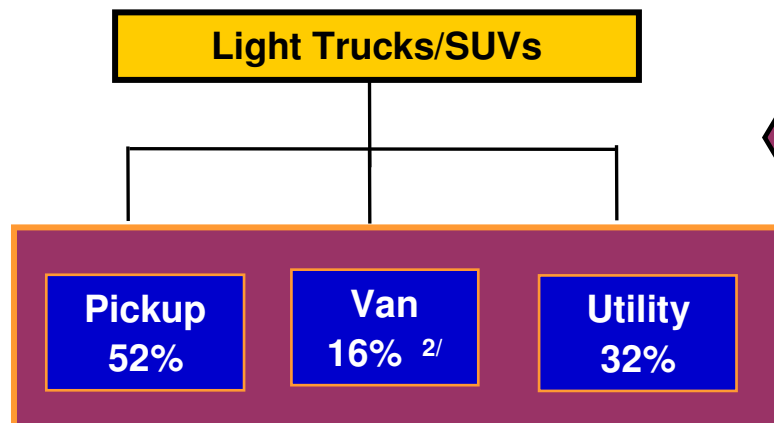


Note: Future truck/SUV segmentation may shift below 6K GVWR due to fuel economy actions

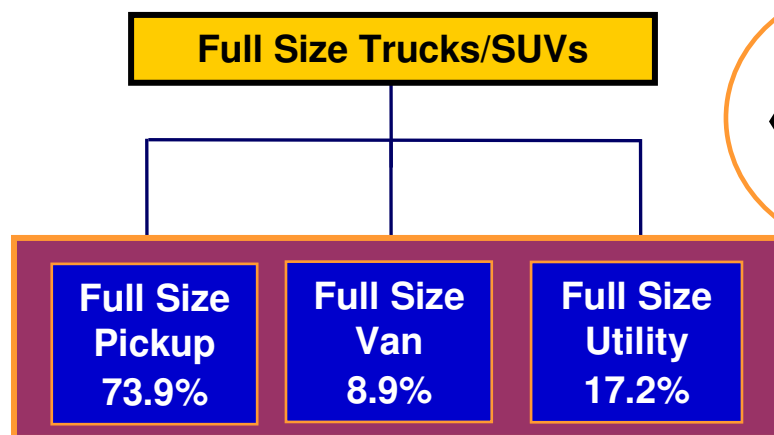
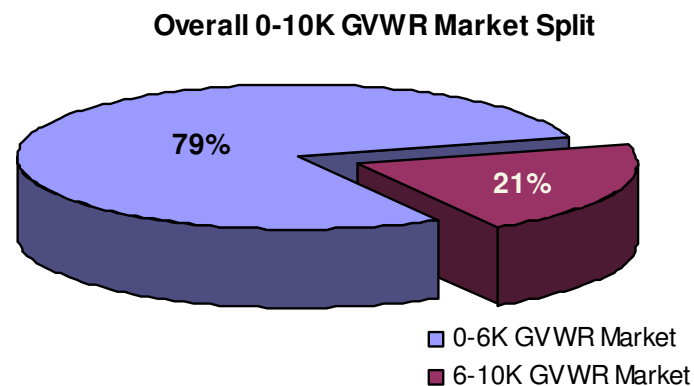
1/ Source: Polk US Registrations September CYTD

2/ Includes minivans (~51% of minivans are >6K, ~49% are <6K)

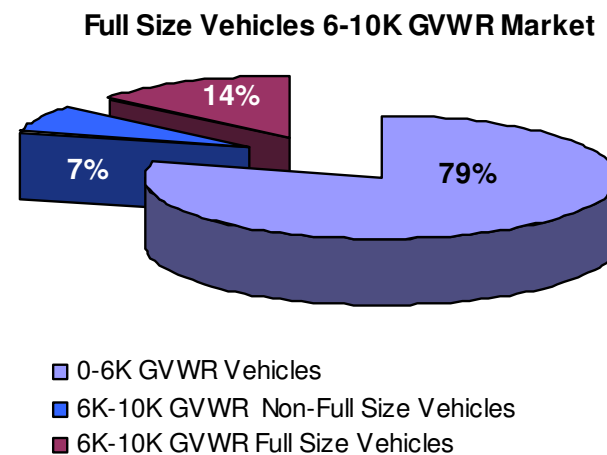
Full Size Truck/SUV Market 14% of Total US New Market Registrations



← 21%



← 14%



Note: Future truck/SUV segmentation may shift below 6K GVWR due to fuel economy actions

Truck/SUV Customer Usage Requirements

As referenced in the Global Technical Regulation (GTR), special consideration may be needed for high front and special purpose vehicles. Trucks/SUVs have unique front-end geometry and architecture from passenger cars and cross-over vehicles in order to provide off-road characteristics, large payload, towing capacity and other special vehicle features.

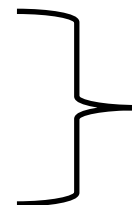
- Typical gross combination weight rating (GCWR) 3X a midsize SUV.
- Large approach angles and running clearances
- Stiff suspension and increased durability
- Heavy-duty bumper systems



Truck/SUV Customer Usage Requirements

➤ Harsh worksite and off-road environments:

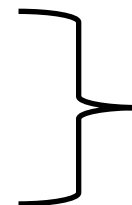
- Construction
- Commercial
- Agriculture, etc.



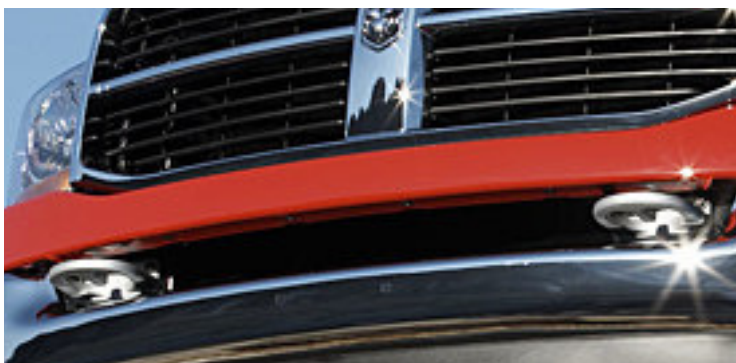
Requires protection from damage, must be fit for intended use

➤ Equipment needs:

- Winches
- Hooks
- Snowplows
- Brush bars, etc.



Requires strong/stiff structure for mounting accessories

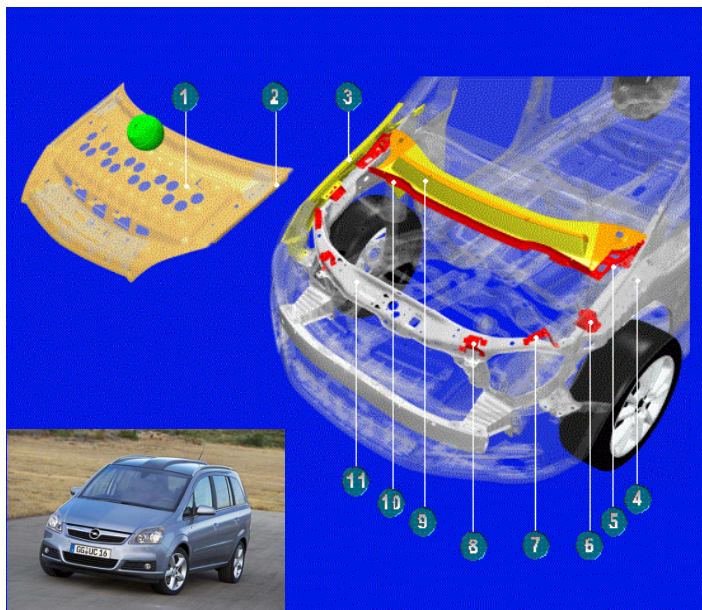


Unique Trucks/SUVs Pedestrian Head Challenges

Truck/SUV Head Impact:

Typical countermeasures, depicted below using the Opel Zafira¹, which are used to meet pedestrian head impact criteria for cars are not off the shelf options for trucks/SUVs. Trucks/SUVs have higher road loads, mass and durability requirements that will require redesign and new solutions for meeting pedestrian head impact criteria.

Opel Zafira II Design for Pedestrian Head Impact ¹⁾



1. Thin steel hood with "muffin tin" design for the hood inner panel
2. Cut-out hood flange
3. Thin steel fender with optimized cut out design
4. Lowered brace wheelhouse
5. Deformable hood hinge
6. Deformable fender bracket front
7. Deformable bumpstop bracket outer
8. Deformable bumpstop bracket inner
9. Deformable multi-part plastic cowl system
10. Plastic service panel with planned fracture points
11. Lowered front upper and front side

1) PEDESTRIAN MEASURES FOR THE OPEL ZAFIRA II (Thomas Wanke, Dr Grace Thompson, Christoph Kerkeling) - Paper Number 05-0237

International Technical Development Center (Adam Opel AG, D-65423 Ruesselsheim, Germany)

Trucks/SUVs Leg Test Procedure Complexity

Bumper Lower Reference Line (LBRL)

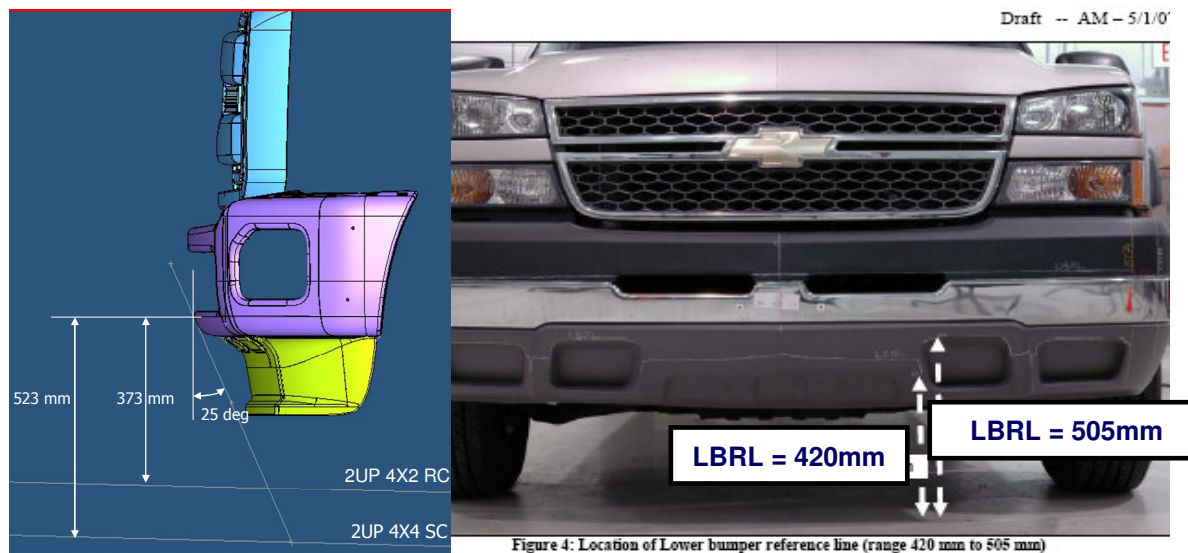


Figure 4: Location of Lower bumper reference line (range 420 mm to 505 mm)

Current GTR LBRL Definition:

- Lower leg test if LBRL < 425 mm
- Upper leg test if LBRL > or = 500mm
- ❖ OEM's choice for LBRL : 425-500 mm

Alliance LBRL Definition Proposals:

Proposal 1:

- ❖ OEM's choice for vehicles with common front-end structures which span both lower and upper leg LBRL

Proposal 2:

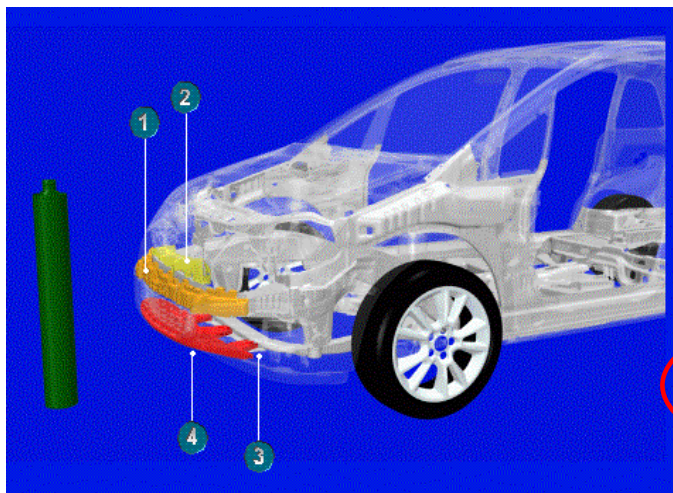
- ❖ For vehicles with common front-end structures which span both lower and upper leg LBRL, OEM to use LBRL measurement from high volume variant vehicle

- Trucks/SUVs have varying ride and ground clearance requirements, both upper leg and lower leg compliance will need to be met due to:
 - Loaded and unloaded conditions, varying wheelbase, 4X4 options and other customer driven usage requirements.
- **Manufacturers should be allowed to choose one legform test option for compliance**

Unique Trucks/SUVs Pedestrian Leg Challenges

Trucks/SUVs Lower and Upper Leg Impact:

The Opel Zafira design solutions and other typical car approaches do not work for large trucks/SUVs. New technology is required to find a solution to meet the GTR upper and lower leg criteria along with satisfying trucks/SUVs architecture and customer usage requirements.



Opel Zafira II Design for Pedestrian Lower Leg Impact ¹

1. Low-density foam with sufficient deformation space to avoid the impactor hitting the stiff, aluminium bumper crossmember
2. Upper bumper support to stabilize the bumper fascia and to avoid the support being pushed backwards with bottoming out.
3. Interface bracket to firmly mount the Lower Bumper Stiffener to the front axle tube.
4. Lower bumper stiffener, firmly mounted to the chassis and bumper fascia, to control the leg kinematics by reducing knee bending.

¹/Source: PEDESTRIAN MEASURES FOR THE OPEL ZAFIRA II (Thomas Wanke, Dr Grace Thompson, Christoph Kerkeling) - Paper Number 05-0237

GTR Amendment Proposals

FlexGTR-PLI Legform:

- Working Party on Passive Safety (GRSP) discussions are on-going regarding the incorporation of the FlexGTR-PLI provisions in Phase 2 of the Pedestrian Protection GTR. Delay of the finalization of GTR9 phase 2 was discussed at the December 2010 GRSP.
- At the December 2010 GRSP, Japan submitted a proposal for the 01 series amendments to the new ECE Regulation on pedestrian safety.
- Once durability concerns are addressed, the Alliance supports the transition to the FlexGTR-PLI legform, provided the proper transition time is granted.

GTR (TRL)
Lower Leg
 $v = 40 \text{ km/h}$

Limits
 $a \leq 170 \text{ g}$
 $\alpha \leq 19^\circ$
 $s \leq 6 \text{ mm}$



Proposed FlexPli
Lower Leg
 $v = 40 \text{ km/h}$

Limits
Tibia $\leq 340 \text{ Nm}$
ACL $\leq 13 \text{ mm}$
PCL $\leq 13 \text{ mm}$
MCL $\leq 22 \text{ mm}$



Summary

Pedestrian Safety Facts and Trucks/SUVs Market Data:

- The US full size truck/SUV market makes up approximately 14% of new vehicle registrations.

Trucks/SUVs Functional Requirements:

- Off-road characteristics, increased payload and towing capacity, higher durability and overall length restrictions
- Harsh environments, the use of snowplows, winches and recovery hooks

Trucks/SUVs Technical Challenges:

- Higher road loads, mass and durability requirements will require new head impact design solutions
- There are no known practicable solutions to meet the GTR leg requirements and satisfy Trucks/SUVs architecture and functionalities.

Trucks/SUVs Implementation Timing:

- The lower bumper reference line (LBRL) should not drive the same vehicle to meet both upper and lower leg, this is not the intent of the GTR.
- More lead time is needed for heavier vehicles as recognized in other regions.



Questions?

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